U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
PB-286 706

Evaluation of the U.S. Geological Survey Laboratory Atlanta, Georgia

Environmental Monitoring and Support Lab -Cincinnati, OH

Jul 78

United States
Environmental Protection
Agency

Environmental Monitoring and Support
Laboratory
Cincinnati OH 45268

EPA-600/7-78-137
July 1978

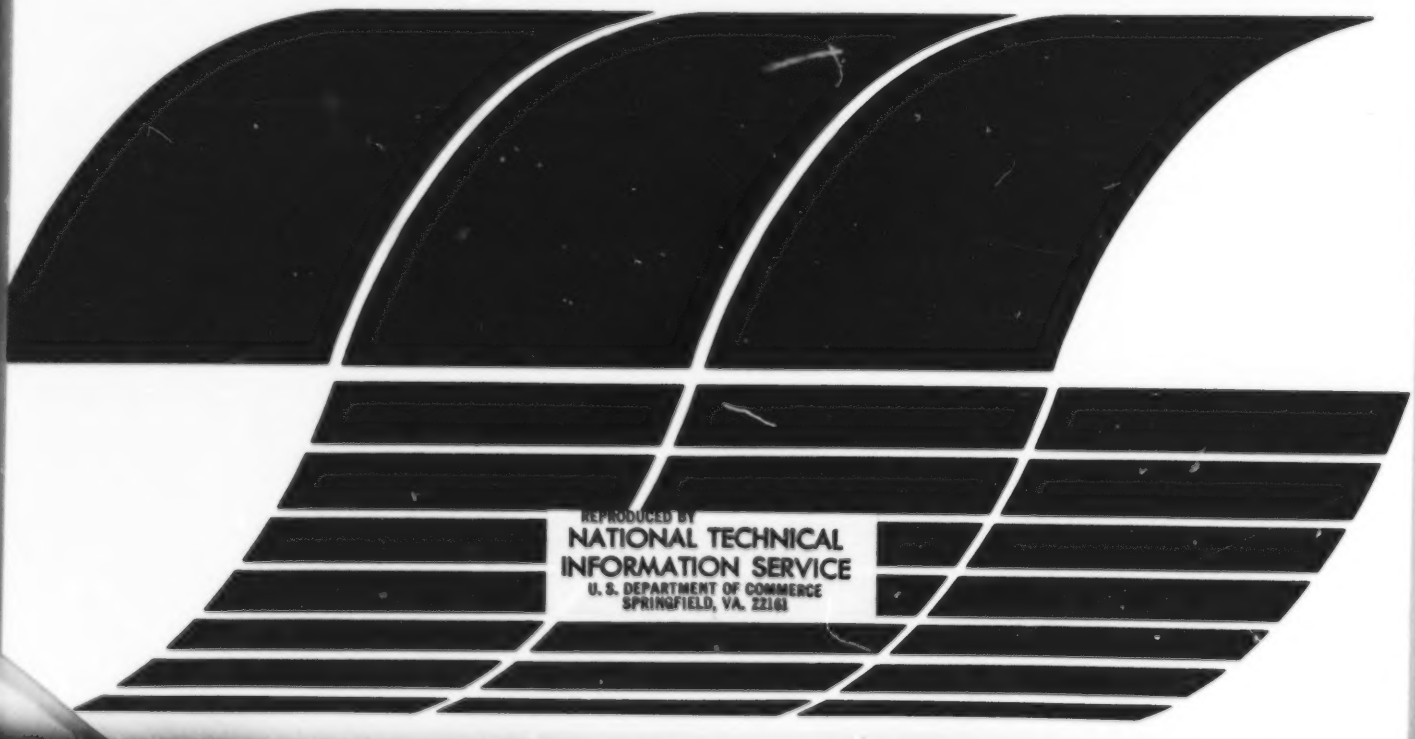
Research and Development

PB 286 706

EPA

Evaluation of the U.S. Geological Survey Laboratory Atlanta, Georgia

Interagency Energy/Environment R&D Program Report



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TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO.
EPA-600/7-78-137		PB286706

4. TITLE AND SUBTITLE	5. REPORT DATE
EVALUATION OF THE UNITED STATES GEOLOGICAL SURVEY LABORATORY, ATLANTA, GEORGIA	July 1978 issuing date
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO.
Robert L. Booth	
9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT NO.
SAME AS BELOW	INE 625
	11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS	13. TYPE OF REPORT AND PERIOD COVERED
Environmental Monitoring and Support Lab. - Cinn, OH Office of Research and Development U.S. Environmental Protection Agency Cincinnati, Ohio 45268	In-House
	14. SPONSORING AGENCY CODE
	EPA/600/06

15. SUPPLEMENTARY NOTES

16. ABSTRACT

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Overall, water analyses for parameters related to the broad areas of chemistry, organics and pesticides, and aquatic biology are being conducted by approved sampling/preservation techniques and laboratory methods. Specific recommendations for areas of improvement are given.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Evaluation Water Analysis Quality Assurance	Valid Data Monitoring, Ambient	14-B

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)*	21. NO. OF PAGES
Release to public	Unclassified	20
	20. SECURITY CLASS *(This page)*	22. PRICE
	Unclassified	PC A02 MF A01

EPA Form 2220-1 (9-73)

☆ U.S. GOVERNMENT PRINTING OFFICE 1978— 757-140/1401

EPA-600/7-78-137
July 1978

EVALUATION OF THE U.S. GEOLOGICAL SURVEY LABORATORY ATLANTA, GEORGIA

by

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FOREWORD

Environmental measurements are required to determine the quality of ambient waters and the character of waste effluents. The Environmental Monitoring and Support Laboratory - Cincinnati conducts research to:

- Develop and evaluate techniques to measure the presence and concentration of physical, chemical, and radiological pollutants in water, wastewater, bottom sediments, and solid waste.

- Investigate methods for the concentration, recovery, and identification of viruses, bacteria, and other microbiological organisms in water. Conduct studies to determine the responses of aquatic organisms to water quality.

- Conduct an agency-wide quality assurance program to assure standardization and quality control of systems for monitoring water and wastewater.

This report summarizes the results of an evaluation of the capabilities of the U.S. Geological Survey Laboratory, Atlanta, Georgia, to provide valid data for the analyses of water and waste samples on a variety of contaminants and parameters commonly requested by the U.S. Environmental Protection Agency.

Dwight G. Ballinger, Director
Environmental Monitoring and Support
Laboratory - Cincinnati

ABSTRACT

An onsite evaluation was made of the capabilities of the U.S. Geological Survey Laboratory at Atlanta, Georgia. Particular emphasis was placed on determining their ability to meet the monitoring requirements connected with their contractual efforts with the U.S. Environmental Protection Agency. This monitoring is a major part of the Environmental Protection Agency's quality assurance program in support of energy-related activities in the eastern United States.

Overall, water analyses for parameters related to the broad areas of chemistry, organics and pesticides, and aquatic biology are being conducted by approved sampling/preservation techniques and laboratory methods. Results on unknown performance samples and cross-check samples were well within acceptable ranges, thus documenting their ability to generate valid data. Specific recommendations for areas of improvement are given.

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SECTION 1

EXECUTIVE SUMMARY

An onsite evaluation was made of the capabilities of the U.S. Geological Survey Laboratory at Atlanta, Georgia. Particular emphasis was placed on determining their ability to meet the monitoring requirements connected with their contractual efforts with the U.S. Environmental Protection Agency (USEPA). This monitoring is a major part of EPA's quality assurance program in support of energy-related activities in the eastern United States.

Team members consisted of Dwight G. Ballinger, Director; Robert L. Booth, Deputy Director; and Cornelius I. Weber, Aquatic Biology Section Chief, of the Environmental Monitoring and Support Laboratory - Cincinnati, Office of Monitoring and Technical Support, Office of Research and Development.

Overall, water analyses for parameters related to the broad areas of chemistry, organics and pesticides, and aquatic biology are being conducted by approved sampling/preservation techniques and laboratory methods. Results on unknown performance samples and cross-check samples were well within acceptable ranges, thus documenting their ability to generate valid data. The laboratory has ample space, services, and equipment. The present staff is composed of well-qualified, conscientious scientists and technicians. There is a need, however, to recognize the overall responsibilities of the Section Chiefs and reclassify their positions to at least one higher GS level.

Although approved sampling/preservation techniques are followed, holding times are often exceeded even before arrival at the laboratory. This problem must be corrected. In addition, a thorough review at the management level concerning more effective use of standard reference materials, duplicates, and spikes is strongly recommended.

SECTION 2

BACKGROUND

An evaluation was made of the U.S. Geological Survey (USGS) Laboratory at Atlanta, Georgia. The evaluation consisted of preliminary questionnaires and an onsite visit January 16 - 20, 1978. The visits included an initial briefing session attended by the USGS senior staff and chaired by Donald Leifeste, Laboratory Director; a general laboratory tour; three days of detailed discussions with their staff (ranging from the respective section chiefs to the personnel working at the bench and responsible for processing the collected samples); and a debriefing attended by Director's Office and members of the evaluation team to discuss the preliminary findings. Subsequently, unknown performance samples were provided by the Quality Assurance Branch, Environmental Monitoring and Support Laboratory - Cincinnati, to document their ability to generate valid data in the areas of trace organics, minerals, nutrients, demand, and trace metal analyses.

SECTION 3

WATER CHEMISTRY

(Reported by Dwight G. Ballinger and Robert L. Booth, EMSL-CI)

Sampling, Preservation, and Holding Times

Most samples are collected by personnel from the USGS District Offices/ Laboratories and shipped to the Atlanta Facility for processing and analyses. Approximately 95% of the samples are surface waters, and 5% are other. At present, no samples are being analyzed for either the Safe Drinking Water Act (SDWA) or the National Pollutant Discharge Elimination System (NPDES).

The Sample Receiving Department is responsible for providing proper containers for sample collection in the field:

1. For trace metals, use polyethylene that has been acid-rinsed.
2. For inorganics, use polyethylene containers direct from manufacturer once only.
3. For TOC and organics, use glass.

Filtration and preservation are done in the field per approved techniques. All samples are processed as soon as possible and are held at least 14 days after data are stored in the terminal. Temperature settings should be verified on storage refrigerators; consideration should be given to a recording-type thermometer.

Recommended holding times are not being observed at all times. Primarily, the problem appears to be in delayed and extended shipment times.

RECOMMENDATION: Institute an immediate program to rectify problems in (1) sample shipment (adhere to recommended holding times), (2) sample receiving (process samples in shortest turn-around time possible), and (3) the laboratory (guarantee timely analyses of received samples).

Analytical Methodology

The laboratory has its own methods that do not necessarily check completely with USGS Techniques of Water Resources Investigations series.

For the most part, however, methodology appeared to be by approved methods manuals. Exceptions to 304(g) test procedures are color and turbidity.

RECOMMENDATION: Document the methodology used in more formal fashion, determine where variances are present, and submit as proposed alternative test procedures for EPA consideration.

Personnel

The Atlanta facility has 40 permanent, 12 permanent part-time, and 12 temporary positions. The ratio of technicians to professionals is approximately two to one. Overall, the staff is composed of well-qualified, conscientious scientists and technicians. There are at least two areas, however, that need additional manpower.

RECOMMENDATION:
1. Provide additional senior staff to conduct project studies.
2. Provide additional professional staff to the Quality Assurance Section to document quality control programs and institute a daily quality control practice.

Space and Services

The Atlanta facility is exceptionally well equipped and capable of performing all the routine analyses in water and waste monitoring. The facility has the latest equipment, particularly in atomic absorption spectroscopy instrumentation, Technicon equipment, and gas chromatography instrumentation.

Data Handling and Review

The Atlanta facility is currently expanding its computer handling of all data by going to an online lab automation system via contract with Lawrence Livermore Laboratories that will be similar to EPA's system operational at EMSL-CI and Region V's Central Laboratory. Their Quality Assurance Section has the responsibility for reviewing all data before it is reported and checking back with the respective Section Chiefs on any problem areas. Results of performance on standard reference materials (USGS water samples used as water quality checks) and computer logic checks are the two basic mechanisms used for determining the validity of the reported data. The Quality Assurance Section does not routinely utilize results of performance on replicates (precision) and spiked (accuracy) samples. Thus for measurements that do not have unknown standard reference materials (SRM), there are no quality control checks other than what the analyst does in preparation of calibration curves.

RECOMMENDATION: A thorough review should be made at the management level to determine the most effective ways of utilizing quality control data generated from SRMs, duplicates, and spikes.

Quality Control

The older version of their quality control program was available for review, but a newly documented plan should be available in the near future. It will be coordinated by David Erdmann, Deputy Laboratory Director and Bernard Malo of USGS. Key elements of the present system are:

1. Use of standard water reference samples (SRMs) furnished by Marv Fishman at least 1 to 3 times per day for major cations/ions and trace metals.

2. SRMs are also submitted as unknowns to analysts on a scheduled basis.

3. Next-morning computer evaluation: Any values that exceed 1.5 x SD* is flagged and reviewed by section responsible for analysis.

4. Also submit samples to District Offices, who in turn ship into Denver on a 1-per-week basis using dummy stations. The following morning results are reviewed. The computer simply states, for example, "chloride missed."

5. Use of EPA nutrients standard only (used only as a check on standard curve).

6. Rejection rate of approximately 20%.

7. Performance of approximately 100 checks, including cation/ion balance checks, that are done automatically by the computer (ditto for total versus dissolved, etc.).

The Organics Section has its own written quality assurance program that operates independently of the above general practice. Key elements of its present system are:

1. Standard checks must fall within $\pm$ 5%. If not, standing current is adjusted.

2. Spiked samples/blanks must be $\geq$ 70%. If not, checks are made on system.

3. Do sample splitting with Denver USGS Lab.

4. Do not use EPA quality assurance check samples or participate in round robin studies.

*SD from Skougstad's/Fishman's RR studies.

Summary of Recommendations by Sections

A. Logistics Support (I)

1. Verify temperature settings on storage refrigerator. Consideration should be given to a recording-type thermometer.

2. Stop using color wheel for color measurements; instead, use approved platinum-cobalt spectrophotometric procedure.

3. Turbidity samples with values greater than 40 NTUs should be diluted and re-run.

B. Automated Wet Methods (II)

1. Use stirrer mechanism (similar to that used for automated mercury) when doing "total" ammonia, nitrate/nitrite, and nitrite. As it is, at best, a decanted sample is being used.

2. In addition to making corrections for color interference, corrections should be made for turbidity interference when necessary.

C. Trace Metals (III)

1. When doing total metals, standards should be carried through the complete digestion step with each sample set (blanks already are).

2. Verify that metal samples have been acidified before beginning any analyses. A simple check with pH paper will suffice.

3. Use the Environmental Protection Agency's Quality Assurance Check Sample, at least on a quarterly basis, as an independent check on the entire system.

4. Check out deionized water, especially before making up primary/working standards.

5. Be more systematic in use of SRMs and in recording of checks made.

D. Manual Methods (IV)

1. When ordered National Bureau of Standards thermometer arrives, institute routine, documented checks on two ovens set at 105° and 180°C.

2. Process metal standards through digestion step (see item C.1)

E. Pesticides (V)

1. Make use of the Environmental Protection Agency's Quality Assurance Check Samples as an independent check on the entire system.

F. Automatic Data Processing

1. Verify data being transferred to computer disc (this is not being done by anybody).

G. Quality Assurance

1. Review computer checks to determine if all parameters possible are being covered.

2.* Broaden use of blind SRMs. Add series for detergents, pesticides, and total organic carbon.

3.* Include ammonia, orthophosphate, and TKN in nutrient series blind SRMs.

4.* Document actions taken on SRMs that are "rejections" and subsequent steps taken to correct potential problems.

H. Management

1. Routine checks need to be made on the deionized water and outlets at sinks need to be policed.

2. Safety Hints:

   a. Not all of the staff use safety glasses.

   b. Box for safety glasses for visitors was empty.

   c. Eye wash facilities are not that noticeable or prevalent in most of the working areas.

3. Staff should be "brought on board" as soon as possible to explain how lab automation system will work, what it will do for them, and how is can be used on a real-time basis to document quality of data.

4. Written quality assurance plan should be prepared as soon as possible that can act as a minimal, base-line program that all Sections must follow (Pesticides was the only section that had a written plan).

5. Better communication is needed between Quality Assurance and the Sections.

*A third person may be needed to do this.

SECTION 4

AQUATIC BIOLOGY

(Reported by Cornelius I. Weber, EMSL-CI)

General Comments

Staff members within the Biology Section are very concerned about the quality of their data, and carry out many basic quality assurance practices. A quality assurance plan was recently prepared, but it has not been implemented. As a result, quality assurance practices are limited largely to instrument calibration.

It is recommended that management assume a more aggressive role in supporting the Biological Quality Assurance Program, and authorize the staff to dedicate a significant part of their time to quality assurance activities. In this regard, it would be advisable to formally designate one of the senior staff as Quality Assurance Officer in the Section, and give them the authority to develop and implement a comprehensive Biological Quality Assurance Program.

Deficiences in the Biological Quality Assurance Program were especially noticable in the following areas: sample replication; the use of blind and split samples; use of available biological reference materials; proofing and verification of data on bench sheets by a second party; use of log books to record instrument calibration, performance checks and service.

Phytoplankton Analysis (Counts and Identification)

Current phytoplankton analyses are limited to counts and identifications to the genus level. Most of the phytoplankton analysis staff are relatively inexperienced. At the time of the onsite evaluation, there was a large backlog of plankton samples. The staff was under considerable pressure to process the samples as rapidly as possible and did not feel free to allocate time for quality assurance. However, adequate quality assurance in the analyses is especially important because of the relative inexperience of most of the bench personnel. It is recommended, therefore, that blind and split samples be incorporated into the sample stream as soon as possible at a level of approximately 10% of the total number of samples processed.

It is recommended that identifications be carried to the species level. Data at the genus level are of very limited use because species within a genus often differ greatly in their response to environmental conditions. Identifications could be carried out to the species level with very little

additional effort and would be much more useful in supporting the mission of the laboratory. It is also recommended that diatom species proportional counts be added to the phytoplankton analyses. Diatom identifications can be taken to the species level with a greater degree of certainty than with other groups, and the data are more useful because of the large literature that has already been published on diatom ecology.

The sampling schedule should be modified to include spring and fall bloom periods. Clump counts should be used instead of cell counts, except for the diatoms because of the preponderance of historical data, and the greater sensibility of the counting unit in data interpretation. The calculations on the completed bench sheets should be routinely verified by a second person to detect arithmetical errors before the data are machined.

Periphyton

Samples are collected primarily for biomass and chlorophyll a measurements, but a qualitative taxonomic analysis, consisting of identifications and determination of relative abundance, is also carried out. Standard practices are employed in the biomass analysis. However, sample collection methods (substrate depth and exposure time) do not conform to generally accepted practices and should be standardized. It is recommended that the substrates be exposed only at (near) the surface of the water for a standard exposure period within the range of 2-4 weeks (preferably 2 weeks), which should be held constant at all stations within a drainage basin. At least three replicate samples should be collected for biomass and chlorophyll a measurements. Bound log books should be used to record data on the performance of the balances, which should be checked with standard weights before, during, and after each group of samples are weighed.

Periphyton samples are analyzed for chlorophyll using high-pressure liquid chromatography. The analysis is limited to chlorophyll a and b. The method is new and was recently submitted to the Journal of Chromatography for publication. It is recommended that the method be checked with standard reference materials available from the Environmental Monitoring and Support Laboratory.

Some carelessness was noted in the handling of incoming samples which must remain frozen to ensure sample integrity. Receiving personnel and the laboratory staff should exercise greater care in sample handling and must discard samples which are not frozen when they arrive from the field.

Macroinvertebrates

Samples are collected with hardboard multiplate samplers and are analyzed to determine numbers, identification and biomass of the organisms. This program is in a pilot phase and samples are collected at only a few stations. It is suggested that the substrates be exposed at a standard depth (within the interval of 1-2 meters) at all stations for a fixed period of time, preferably 4-6 weeks. At least three replicates samples should be taken at each station.

Organisms should be identified to the species level whenever possible for the same reasons discussed under the phytoplankton section.

Adenosine Triphosphate (ATP)

Kits are supplied to field personnel for the extraction of ATP from seston in grab water samples, and the extract is returned to the laboratory for analysis. The instrument calibration is thorough. However, the sample preparation instructions in the field kit are inadequate and should be modified to prevent the loss of ATP (the details of this problem were discussed with Dr. Shoaf). Arrangements should also be made with field personnel to collect replicate samples and to provide blind and split samples. Laboratory personnel should take advantage of round robin samples available from the American Society for Testing and Materials (ASTM) (a second round robin will be carried out in 1978). Reference samples will be available from the Quality Assurance Branch, Environmental Monitoring and Support Laboratory - Cincinnati, in 1979.

Algal Growth Potential (AGP)

The method employed for the AGP analysis is essentially the one developed by the EPA with some modifications. If only one AGP value is to be obtained, it is recommended that the "total" AGP be measured. In this case, samples should be autoclaved before filtering to release the nutrients in the particulate fraction. These nutrients are generally recycled within the plankton community and would be available for algal growth. If the AGP of the "residual" nutrients (dissolved nutrients only) is desired as a second value, aliquots of the sample could be filtered (without autoclaving) and analyzed along with autoclaved-filtered aliquots.

The calibration of the Coulter Counter appeared to be adequate, but it is suggested that the instrument be checked regularly with the "simulated plankton" reference sample available from the Quality Assurance Branch, Environmental Monitoring and Support Laboratory - Cincinnati. Three replicate inoculations of standard culture medium should be incubated with each group of field samples as a quality assurance check on culture conditions, and the factor employed to convert cell volume to dry weight ("yield") should be validated. It is also recommended that temperature recorders be installed on the exterior of all environmental chambers.

SECTION 5

PERFORMANCE EVALUATION

(Conducted by John A. Winter, EMSL-CI)

Performance evaluation samples were analyzed by the laboratory staff for the following groups: trace metals, minerals, nutrients, demands and trace organics. Results of these analyses were reported directly to the Quality Assurance Branch, Environmental Monitoring and Support Laboratory - Cincinnati, and processed by means of a computer program that compared reported values to actual values in relation to results from previous EPA method studies or from similar, interlaboratory data.

Overall, the laboratory staff performed very well. A low level result on one of the arsenic samples was reported, but subsequent analyses of additional check and performance samples were acceptable. Likewise, unacceptable results on fluoride were corrected in a subsequent set of samples; apparently, the initial error was due to mislabeling and not to a laboratory analysis problem. Data were not reported for selenium and dieldrin in the first set of samples, but subsequent checks were acceptable. Thus, the laboratory ultimately showed satisfactory performance for all the parameters cited in the following major groups:

Trace Metals	Minerals	Organics
Aluminum	Calcium	Aldrin
Arsenic	Chloride	Chlordane
Beryllium	Fluoride	Dieldrin
Cadmium	Magnesium	DDD
Cobalt	pH	DDE
Chromium	Potassium	DDT
Copper	Sodium	Heptachlor
Iron	Specific Conductane	PCB (1016)
Mercury	Sulfate	PCB (1254)
Manganese	TDS	PCB (1016 and 1254)
Nickel	Total Alkalinity	
Lead		Nutrients
Selenium	Demands	
Zinc		Ammonia-N
	COD	Kjeldahl-N
	TOC	Nitrate-N
		Orthophosphate
		Total Phosphorus